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Participatory control of Newcastle disease in village poultry using thermo-stable Newcastle disease vaccines in Bulle district of Gedio zone, Southern Ethiopia

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Abstract

Newcastle Disease (ND) is regarded as one of the major diseases of poultry because of the devastating losses that the virulent form of the virus can impose on both commercial and village chicken. However, the disease can be controlled through the administration of effective vaccines. Almost all the commercially available vaccines require refrigeration and begin to deteriorate rapidly after 1-2 hours if left at room temperature (around 25°C). Subsequently, because maintaining an adequate supply of refrigerated facilities may be a difficult task in many developing countries with unreliable electrical supplies, the development and large scale production and utilization of an effective thermo-stable Newcastle disease vaccine seems imperative to support rural poultry industry. Participatory/action research on vaccination of village poultry against Newcastle disease (ND) was carried out in two selected villages of Bullie district of Gedio zone, southern Ethiopia; with an objective to demonstrate community based thermo-stable ND vaccination scheme and thereby; to increase the population of chicken in backyard production system. We have selected four community vaccinators, two per each village and trained on diagnosis of major poultry diseases, with the major emphasis on Newcastle disease, on preparation, handling and administration of thermo-sable ND vaccine. From the two villages, we have vaccinated 362 chicken of all age ranges of 54 households, in the two rounds. For the vaccination we have selected a site which is suitable for household members to bring their chicken for vaccine administration. We used eye drop technique to administer a vaccine, by preparing one eye drop in one dose base for all age groups. We administered a vaccine before a pick prevalence of Newcastle disease in the study area, for the remaining three months, data was collected on the mortality rate of the chicken. The result shows that, of the total vaccinated chicken (362) from the two villages on the two rounds, 51 chicken were dead due to diseases, of the cases with a clinical sign not related with Newcastle disease. The total mortality rate of 14%, in this study shows that, thermo-stable Newcastle disease vaccine applied via eye drop is the most effective method for control Newcastle disease in village chicken. Therefore; with proper use of vaccine and vaccination programs using well trained community vaccinators, we can reduce village chicken mortality highly to enhance productivity of rural community at large.

Keywords: Thermos-stable vaccine, village, Newcastle disease, community

Introduction

Ethiopia is a country with a huge population of livestock, 70 million cattle, 43 million sheep, 52 million goats and 57 million chicken. The Ethiopian poultry population is almost entirely composed of indigenous chicken. Recent estimates showed that 78.85%, 12.03%, and 9.11% are indigenous, hybrids and exotic breeds, respectively. (CSA, 2020/21) [8]. The Southern Nation, Nationalities and Peoples Region contributed 11 million and holds about 19% of the total national chicken population (CSA 2020/21) [8]. This region contributes about 18% of the total annual national egg and poultry meat production. From the total population, 99% are raised under the traditional backyard system of management with little or no inputs for housing, feeding or health care, while 1% is under intensive management system (Ashenafi and Eshetu, 2004). Chicken production plays a crucial role in the provision of affordable animal protein for human food consumption and cash income generating (Tamir S., *et al*, 2015) [16]. It also creates an employment opportunity for the youth, elders, and women in rural, peri-urban, and urban areas (Abraham L. and Yayneshet T.). Poultry production offers considerable opportunities for generating employment, improving family nutrition, empowering women (especially in rural areas) and ultimately ensuring household food security. The total number of small-scale intensive poultry producers and their specific contribution to the national poultry production is not known. However, they provide the largest share of poultry eggs and meat to the growing urban population (Boere *et al*., 2015) [5].

Chickens are susceptible to many infectious diseases. One of the most important of these is the viral disease known as Newcastle disease, which is one of devastating diseases of poultry affecting all age ranges of chicken in urban and rural part of the country. The disease kills up to 70-100% of household poultry and therefore is of major economic importance constraining village poultry production. Reducing losses of large numbers of village chickens to virulent Newcastle disease is an essential first step to improving their productivity. Newcastle disease can be controlled by the use of vaccines. Many Newcastle disease vaccines deteriorate after storage for one or two hours at room temperature. This makes them unsuitable for use in villages where the vaccine may need to be transported for hours or in some cases days at ambient temperature. A thermo-stable vaccine enables distributors and users to reduce the problems associated with inadequate cold chains in the field. It is essential that users understand that a thermo-stable vaccine must still be treated with some of the respect due to a biological product that is the vaccine cannot expose to sunlight and frequent shifts in temperature and still expect it to remain active (Alders and Spradbrow, 2001a) [2].

Rural poultry production is recognized as an important activity in all developing countries. Chicken in traditional village poultry systems provide scarce animal protein in the form of meat and eggs, and are available for sale or barter in societies where cash is not abundant. They are generally owned and managed by women and children (Spradbrow 1994; Guèye 2000). Village chicken also fulfills a range of other functions for which it is difficult to assign a monetary value. They are active in pest control, provide manure, are required for special festivals and to meet social obligations, they are essential for many traditional ceremonies and traditional treatment of illness (Alders 2003) [3]. Poultry are often essential elements of female-headed and poor households. This is a particularly important contribution in areas where child malnutrition is common. Malnutrition has wider implications for development because protein-energy malnutrition in children inhibits their growth, increases their risk of morbidity, affects their mental development, and reduces their subsequent school performance and labor productivity (Pinstrup-Andersen *et al*. 1993).

In many developing countries, circulating strains of Newcastle disease virus are capable of causing 100 % mortality in unprotected flocks. Outbreaks of Newcastle disease virus are unpredictable and discourage villagers from paying proper attention to the husbandry and welfare of their chicken. No progress has been made in controlling the disease in free-ranging village flocks, which represent more than 80 percent of the total poultry population in developing countries (Guèye 2000) [10]. In most developing countries, ND occurs every year and kills up to 100 percent of the unvaccinated rural family poultry (Guèye 2000) [10]. Therefore, Newcastle disease control can appropriately beused as an entry-point for developing the poultry sub-sector as a whole (Guèye 2000) [10]. It is however extremely difficult to organize vaccination campaigns covering free-range birds, and the main constraints are related to the characteristics of the husbandry systems practiced (i.e. small flock sizes, multi-age birds, scattered flocks over a vast area, birds not usually housed, etc.). Moreover, conventional vaccines are not available either in small-doses or in small-lot ampoules. Cold storage, which these thermo-labile vaccines require, is not available in rural areas in developing countries. The heat-resistant vaccines against ND (i.e. V4 and I-2 strains) developed by Peter B. Spradbrow and his colleagues at the University of Queensland in Australia appear to offer considerable prospects for controlling ND in rural poultry production (Spradbrow 1996). Thermo-stable ND vaccine is less sensitive for temperature than conventional Lasota vaccine, so it can be administered with ease in rural areas and any trained person can administer it. So the objectives of this study are; to demonstrate community based thermo-stable ND vaccination scheme and thereby; to increase the population of chicken in backyard production system to enhance economic status of villagers.

Methodology

The study was conducted in Bullie district of Gedio zone. From the district two potential villages were selected purposively. The study was conducted on village chicken. For this study 54 farmers having 3 and above chicken of different age ranges were selected. Two community vaccinators from each village were selected and trained on the diagnosis of poultry diseases; paying special attention to Newcastle disease. Development agents (Animal health assistants) also trained on proper diagnosis of the disease and handling and administration of the vaccine, to follow up community vaccinators. Community vaccinators were also practiced on the way how to handle, prepare and administer a thermo-stable Newcastle disease vaccine. They also took part in community mobilization to bring their chicken irrespective of their ages to selected farmers training center (FTC) for vaccination. Data was collected on date of vaccination, morbidity and mortality rates after first and second round vaccination. The dosage was calculated as a single drop to be equivalent with a single dose of vaccine, irrespective of the ages of chicken. The vaccine was dissolved using spring water which was boiled and cooled. We use eye drop technique for this activity. On the first round 255 village chicken were vaccinated and on the second round (after three months) 107 chicken were vaccinated.

Result and Discussion

First and second round vaccination were done for selected chicken from the two villages of the district in three months interval. The first round vaccination was commenced before the onset of a disease in the study area. In this study 54 farmers were participated (vaccinated their chicken). In total 362 chicken were vaccinated; in the first round 255 and 107 chicken on the second round were vaccinated. The number of chicken reduced on the second round due to an absence of farmers (they didn't brought their chicken for vaccination due to several social issues).

Table 1: Chickens vaccinated on the two rounds in the district

Variables	N	Minimum	Maximum	Sum	Mean
Vaccinated chickens on first round	54	0	13	255	4.72
Vaccinated chickens on second round	54	0	16	107	1.98
Total				362	

An average number of chicken per each household were five. The mortality rate following a two round vaccination was 14% (51 chicken were dead out of 362 chickens vaccinated).The cause of mortality were other diseases than Newcastle disease based on the clinical sign. Different study shows there will be a mortality rate of >80% without vaccination intervention for a Newcastle disease/in unprotected group/ (Alexander *et al.*, 2004; Tadiose *et al.*, 2016; OIE, 2013) [4, 17, 14]. As we had intervened only Newcastle disease via vaccination, whereas, the rest management and disease control were performed based on farmer's previous practices, the result indicates that, it's possible to reduce mortality rate of chicken in rural poultry farming using thermo-stable new castle disease vaccine. This also has contributed a lot to enhance production and productivity of rural poultry farming. As the Newcastle disease is an endemic poultry disease and known to cause heavy losses in village chicken, controlling the disease using thermo-stable Newcastle disease vaccine is the most effective technique, to reduce the mortality and production loss. To implement this effectively in village chicken using well trained community vaccinators is of the great importance. Therefore it's possible to reduce massive chicken mortality due to Newcastle disease through vaccination in three months interval annually using thermo-stable vaccine by training and providing vaccine, and facilitating an incentive for community vaccinators in rural poultry farming.

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